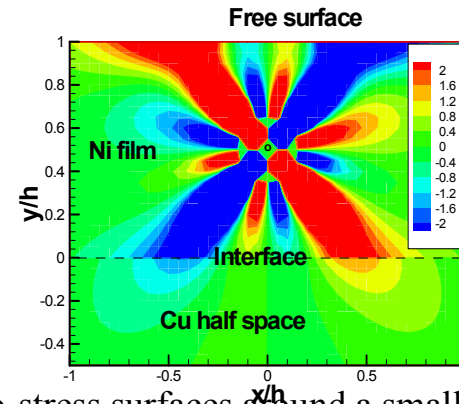


Large-scale Dislocation Dynamics Simulations for Computational Design of Semiconductor Thin Films

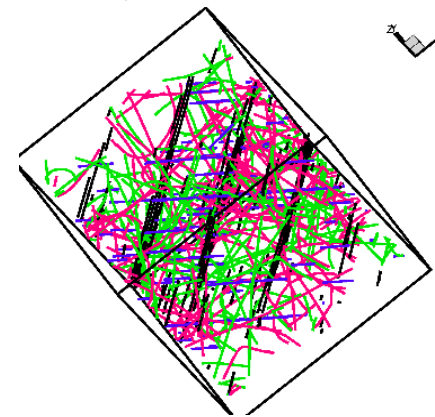
Nasr M. Ghoniem, University of California, Los Angeles, DMR-0113555

As a result of recent progress in manufacturing and engineering utilization of nano- and micro-scale structures, there is urgent need for approaches that are capable of predicting the reliability of these structures. We developed parallel computer software, based on discrete dislocation dynamics, which predicts deformation and failure of sub-micron semiconductor microelectronic structures. The developed software is used to design desired mechanical properties of semiconductor thin film-substrate materials for nano- and micro-applications.

Philosophical Magazine, November 2003.



In-plane iso-stress surfaces around a small dislocation loop in a thin Nickel film on a Cu substrate. The elastic field and internal stress of anisotropic, multi-layer thin films can be determined by our software.



Simulated dislocation microstructure of a “single Cu crystal” at 0.3% strain. Colors indicate various slip systems.

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Education:

Two undergraduate students: Jon Sugar and William Newsome, and two graduate students: Qiang Hu and Zhiqiang Wang contributed to this research. The Ph.D. thesis of Qiang Hu is on the design of self-assembled quantum dots, as a result of extending the original software, developed by Xueli Han (Post-doctor) and the P.I. The research has contributed to a new seminar course at UCLA (MAE259B: Advanced topics in Solid Mechanics). The course covers many topics in nano- and micro-mechanics, and some of the material is derived from this NSF-supported research.

Outreach:

During summer 2003, two high school students: Aaron Mensch and Ehab Elnaga joined our research group at UCLA. They have both contributed to computer visualization and literature research.

